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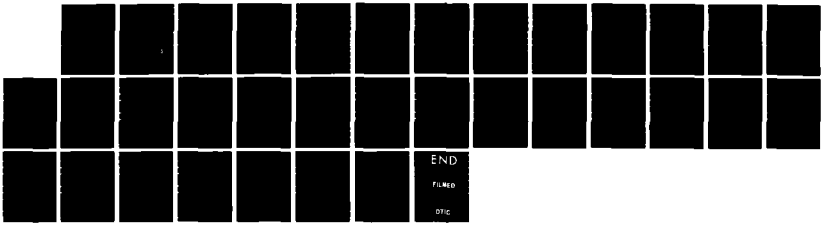

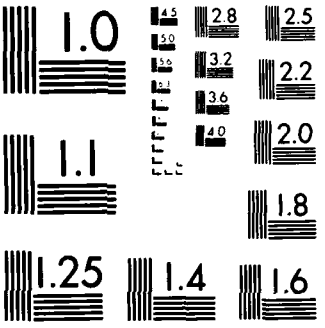

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MEDICAL ENTOMOLOGY PROJECT

ANNUAL AND FINAL REPORT

Oliver S. Flint, Jr.

January 1984

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Studies conducted on the mosquito fauna of Southeast Asia, Africa and Latin America over a nine year period were presented in 81 publications which included 15 monographs. These are cited in Appendix 1. Seventy-three species and one subgenus were described as new. These monographs and papers have provided complete descriptions or redescriptions for all stages, when known, of approximately 425 species. Procedures were developed for the recognition of many important vectors of malaria and arboviruses in Southeast Asia, Africa

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Propably the most significant result was that achieved jointly with the Armed Forces Research Institute of Medical Science (AFRIMS), Bangkok, showing that one of the primary malaria vectors, *Anopheles balabacensis*, is a complex of at least 10 species in Southeast Asia of which 4 or more are found in Thailand.

In the final year of the project, the distinctiveness of the last 4 sibling species of the *Anopheles balabacensis* complex was shown bv work at the Medical Entomology Project (MEP) and AFRIMS. Work on the African arbovirus vector species of *Aedes (Stegomyia)* has resulted in considerable clarification of species concepts, their ranges, and significance as vectors, which is finally producing a coherent picture of disease epidemiology.

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SUMMARY

Studies conducted on the mosquito fauna of Southeast Asia, Africa and Latin America over a nine year period were presented in 81 publications which included 15 monographs. These are cited in Appendix 1. Seventy three species and one subgenus were described as new. These monographs and papers have provided complete descriptions or redescriptions for all stages, when known, of approximately 425 species (Appendix 2). Procedures were developed for the recognition of many important vectors of malaria and arboviruses in Southeast Asia, Africa and South and Central America and these were made available to field personnel through training courses and identification keys. Over 179,000 specimens were accessioned into the project (Appendices 3 and 4).

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INTRODUCTION

The importance of mosquitoes as vectors of human pathogens in all parts of the world has been appreciated since the early part of this century. In spite of the extensive work that has been done on some groups of mosquitoes in various regions of the world, there is a great lack of modern, biosystematic, revisionary studies of most groups of mosquitoes in all areas of the world. The widespread distribution of malaria with the resurgence of drug resistant strains, periodic epidemics of Encephalitis and Dengue Fever, and discovery of new arboviruses in most parts of the world, have made necessary detailed studies of the vector groups of mosquitoes. In order to effectively control the disease vectors it is necessary to complete a meticulous study of the mosquitoes present, define their specific characteristics, and develop reliable methods for recognizing the species.

The Medical Entomology Project (MEP) is a successor to the Southeast Asia Mosquito Project (SEAMP) which was also supported by the U.S. Army Medical Research and Development Command during the period 1964 to 1974. The latter project was developed jointly by scientists in the USA and abroad to answer the need expressed by the U.S. Army Medical Component, Southeast Asia Treaty Organization (SEATO), in Bangkok for help with the identification of mosquitoes of medical importance. The Department of Entomology, National Museum of Natural History, Smithsonian Institution, was selected as the most appropriate organization due to their interest in the project, the presence of extensive collections and libraries, and the active participation of mosquito taxonomists from the Systematic Entomology Laboratory, U.S. Department of Agriculture and the Walter Reed Army Institute of Research.

After this highly successful project was terminated, it was succeeded by MEP which at first had the same basic aim to study all the mosquito fauna of Southeast Asia. However, the efforts were soon restricted to the most important vector groups of mosquitoes--Aedes (Stegomyia), Anopheles and Culex. As revisionary studies on these groups were completed during the 1970's, other medically important groups of mosquitoes were targeted for study. The Venezuelan Equine Encephalitis epidemic in Mexico and Texas in 1971 stimulated interest in the study of Culex (Melanoconion), the primary vector taxon for this group of diseases in the New World. Interest in Dengue and other arbovirus diseases in Africa that were being studied by U.S. Army Medical Research Unit in Kenya led to the studies on the systematics of the primary vectors of these diseases which are the Stegomyia species of Aedes. The political disenchantment with "Southeast Asia" was partially responsible for the "new direction" mentioned above; however, AFRIMS and the Mahidol University in Bangkok continued working on malaria and related problems, especially after a strong resurgence of the disease in the mid 70's. As a result a strong cooperative program developed between the three organizations studying the known vectors of the Anopheles Leucosphyrus Group, which has resulted in the discovery of up to ten cryptic sibling species.

The work of MEP has been published through two channels. The first consists of short articles announcing the discovery of new species, new synonymies, distributions or systematic arrangements. Such articles are submitted for publication in various journals that often offer rapid publication. The second comprises major works dealing with genera, subgenera or species group in a complete and uniform manner as regards format, illustra-

tions and descriptions. These works are published by the American Entomological Institute in its Contributions series as a group of definitive studies entitled "Medical Entomology Studies."

PRINCIPAL SCIENTIFIC ACCOMPLISHMENTS

The principal achievements of the Medical Entomology Project can be relegated to four main areas which are the publication of research papers, acquisition of collections and their management, identification of specimens, and training of personnel.

1. Publication of research papers. The results of the investigation of the staff are presented in the 81 publications listed in the bibliography (Appendix 1). Details concerning the research involved has been described in the previous annual reports (Annual Reports 1 through 8: September 12, 1975; September 1, 1976; September 1, 1977; January 1, 1979; January, 1980; January, 1981; January, 1982; January, 1983) of the Medical Entomology Project.

It is difficult to assess the practical importance of the scientific work which has been published, as often much of the biosystematic information only becomes of epidemiological value during the investigation of a disease epidemic many years subsequent to publication. However, we suggest research in two particular areas will be of immediate value to studies of mosquito borne diseases.

First, the joint studies between MEP, AFRIMS and Mahidol University on Anopheles balabacensis utilizing classical morphological systematics, interbreeding, compatibility studies, biochemical techniques, metaphase karyotypes, and banding pattern on giant chromosomes have all been corroborative of the presence of a large complex of sibling species. The first indication of this complex was the description of Anopheles dirus by Peyton and Harrison in 1979. Since then continuing studies have shown that dirus is a complex of 7 sibling species and that balabacensis of another 3 species. These sibling species differ in many biological characteristics such as breeding and feeding habits and often distribution, even though three different species have been found in one area in Thailand.

The second breakthrough is just now becoming evident. It concerns the African Aedes (Stegomyia) species of the Africanus, Simpsoni, Poweri, and Pseudonigeria Complexes. Material recently obtained from African museums or reared from field collections by Y.-M. Huang have shown that many earlier reports of particular species being vectors of Yellow Fever, Dengue, or other arboviruses are based on misidentifications and will have be reevaluated. Some species (e.g., bromeliae and lilii) were incorrectly placed in synonymy, undescribed species were overlooked (in the Africanus Complex), or simple misidentifications (of simpsoni) were made. It is still too early to predict the final outcome of these studies, but seems clear that the vector capabilities of many species and their ranges will be greatly clarified.

In addition to the accomplishments listed above, certain papers have added significantly to our knowledge of mosquitoes. These are briefly cited below in chronological sequence.

(a) List of mosquitoes recently collected in Sri Lanka (Harrison et al., 1974).

(b) Revision of Aedes from the Oriental Region (Reinert, 1974-81).

(c) Review of the arbovirus vectors of the Culex vishnui Complex in Southeastern Asia (Sirivanakarn, 1975).

(d) A synthesis of data on taxonomy, biology and medical significance of the subgenus Anopheles in Thailand (Harrison and Scanlon, 1975).

(e) A review of the Anopheles crucians subgroup of the United States (Floore et al., 1976).

(f) The Oriental species of the subgenus Culex (Lophoceraomyia) revised (Sirivanakarn, 1976-77).

(g) Review of the recent changes in the epidemiology of Filariasis (de Meillon, 1977).

(h) Examination of the patterns of change in the transmission of Malaria (Ward, 1977).

(i) Revises the medically important subgenus Stegomyia of Aedes in Southeastern Asia (Huang, 1977-79).

(j) The Oriental subgenus Christophersiomyia of Aedes is revised (Abercombie, 1977).

(k) The Southeast Asia species of Uranotaenia (Pseudoficalbia) revised (Peyton, 1977).

(l) Preparation of a mosquito taxonomic glossary to assist in the formulation of a uniform system of describing mosquito structure (Harbach and Knight, 1977-82).

(m) Designates and describes a neotype for the southern house mosquito, Culex quinquefasciatus Say (Sirivanakarn, 1978).

(n) Describes a new anopheline vector of malaria from Thailand (Peyton and Harrison 1979).

(o) Revises the mosquitoes of Japan (Tanaka et al., 1979).

(p) The New World malaria vectors of the genus Anopheles subgenus Nyssorhynchus are revised (Faran, 1980).

(q) Studies on the New World arbovirus vectors of the subgenus Melanoconion, genus Culex (Sirivanakarn, 1980-81).

(r) Revises the Aedes Scutellaris Group, the primary filarial vectors on Tonga (Huang and Hitchcock, 1980).

(s) The Myzomyia Series of Anopheles, important malaria vectors in Thailand are revised (Harrison, 1980).

(t) The Southeast Asian genus Tripteroides revised in part (Mattingly, 1981).

(u) Produces a handbook of the Amazonian anophelines (Faran and Linthicum, 1981).

(v) Lists the mosquitoes collected in Bolivia during a survey of vectors of yellow fever and dengue (Peyton et al., 1983).

2. Acquisition of collections and their management. At the start of the SEAMP project in 1964, the National Museum of Natural History possessed several thousand specimens of Southeast Asian mosquitoes, which was totally inadequate for the type of work to be undertaken. Efforts were undertaken to rapidly expand the available material. The SEATO Medical Research Laboratory responded by providing a collection of over 79,000 specimens and Dr. S. Ramalingam, of the University of Malaysia, added another 50,000 specimens from Malaysia. These collections were especially important because most species are represented by reared series consisting of associated larval and pupal skins and their associated adults. In addition much important, historical material was borrowed from museums all over the world. By the end of SEAMP over 200,000 specimens had been added to the original collection.

During the period of this contract, over 179,000 specimens (Appendix 4) were accessioned by the project in 600 separate transactions. The major accessions, those involving more than a total of 200 specimens, are summarized in Appendix 3.

The most significant acquisition during this time was the Mosquitoes of Middle America Collection brought together by Dr. John N. Belkin. Through the joint action of the Smithsonian Institution, WRAIR, and MEP the collection was carefully packed and moved to Washington. Although it has not yet been counted and officially accessioned, it is estimated to contain around 500,000 specimens. This collection combined with the old, but very valuable, collection of the National Museum, gives the Museum the outstanding Latin American, South Pacific and Southeast Asian collections in the world.

3. Identification of specimens. During the past years, the staff (Appendix 5) and consultants (Appendix 6) of the project have been recognized as the source of accurate identifications for mosquitoes from any region of the world. Through their efforts, many thousands of specimens of critical epidemiological interest to the U.S. military services, public health officials of both national and international organizations, and scientists throughout the world have received prompt identifications. This has provided unvaluable reference material for investigations on malaria, filariasis, the dengues and other arboviruses infections.

4. Training of personnel. Throughout the term of this project, we have welcomed personnel from the Armed Forces to the project for periods of a few days to weeks. While here they have learned proper techniques for rearing and preparing material and obtained the references necessary to study the fauna in the part of the world to which they were assigned. Similarly we have provided training for technicians and scientists from many Third World countries. These people have proven extremely valuable to us not only in material that they have provided, but also in the help they provide our personnel when they undertake field work in their countries.

The most significant aspect of this training has involved the assignment

of military entomologists to the Walter Reed Biosystematics Unit who have conducted their research at the Smithsonian Institution. Through this procedure the Army Medical Service has received significant benefits, and in turn, these officers have contributed to 32 of the 81 publications of the project.

51. Culex (Eumelanomyia) mohani Sirivanakarn 1977
52. Anopheles (Nyssorhynchus) trinkae Faran 1979
53. " (Cellia) dirus Peyton & Harrison 1979
54. Culex (Melanoconion) penai Sirivanakarn 1979
55. " " lopesi Sirivanakarn & Jakob 1979
56. Aedes (Isoaedes) cavaticus Reinert 1979
57. Culex (Eumelanomyia) hayashii ryukyuanus Tanaka, et al. 1979
58. " (Lutzia) shinonagai " " "
59. Heizmannia kana " " "
60. Aedes (Ochlerotatus) impiger daisetsuzanus " " "
61. " " hexodontus hokkaidensis " " "
62. " (Finlaya) japonicus amamiensis " " "
63. " " " yaeyamensis " " "
64. " " nishikawai " " "
65. " (Stegomyia) flavopictus miyarai " " "
66. " " wadai " " "
67. Uranotaenia (Pseudoficalbia) novobscura ryukyuana " " "
68. Tripteriodes (Tripteroides) bambusa yaeyamensis " " "
69. Culex (Melanoconion) pedroi Sirivanakarn & Belkin 1980
70. " " adamesi Sirivanakarn & Galindo 1980
71. Aedes (Stegomyia) kesseli Huang & Hitchcock 1980
72. " " ledgeri Huang 1981
73. Tripteroides (Rachionotomyia) nepenthisimilis Mattingly 1981
74. Aedes (Isoaedes) Reinert 1971

Appendix 2.

NEW TAXA DESCRIBED BY THE MEDICAL ENTOMOLOGY PROJECT

1. *Aedes (Stegomyia) seampi* Huang 1974
2. *Uranotaenia (Pseudoficalbia) srilankensis* Peyton 1974
3. *Aedes (Verralina) comosus* Reinert 1974
4. " " *harrisonicus* " "
5. " " *jehorensis* " "
6. " " *pseudovarietas* " "
7. " " *ramalingami* " "
8. " " *sabahensis* " "
9. " " *sohni* " "
10. *Anopheles (Anopheles) aberrans* Harrison and Scanlon 1975
11. *Aedes (Stegomyia) krombeini* Huang 1975
12. *Culex (Eumelanomyia) manusensis* Sirivanakarn 1975
13. " " *macrostylus* Sirivanakarn & Ramalingan 1976
14. " (Culex) *luzonensis* Sirivanakarn 1976
15. " " *selangorensis* " "
16. " " *longicornis* " "
17. " " *kinabaluensis* " "
18. " " *philippinensis* " "
19. *Forcipomyia (Caloforcipomyia) hermosa* Utmar & Wirth 1976
20. " " *remigera* " " "
21. " " *sabalitensis* " " "
22. " " *copanensis* " " "
23. " " *hatoensis* " " "
24. *Aedes (Paraedes) thailandensis* Reinert 1976
25. " (Rhinoskusea) *wardi* " "
26. *Anopheles (Cellia) deaconi* de Meillon & van Eeden 1976
27. *Culex (Eumelanomyia) jefferyi* Sirivanakarn 1977
28. " (Culiciomyia) *harrisoni* " "
29. " (Lophoceraomyia) *alorensis* " "
30. " " *paraculeatus* " "
31. " " *aestivus* " "
32. " " *gracicornis* " "
33. " " *pairoji* " "
34. " " *impostor* " "
35. " " *wardi* " "
36. " " *lasiopalpis* " "
37. " " *hirtipalpis* " "
38. *Uranotaenia (Pseudoficalbia) abdita* Peyton 1977
39. " " *abstrusa* " "
40. " " *albipes* " "
41. " " *approximata* " "
42. " " *confusa* " "
43. " " *enigmatica* " "
44. " " *harrisoni* " "
45. " " *moufiedi* " "
46. " " *nocticola* " "
47. " " *patriciae* " "
48. " " *propinqua* " "
49. " " *quasimodesta* " "
50. " " *reinerti* " "

78. Harbach, R. E. and K. L. Knight. 1982. Corrections and additions to Taxonomist's Glossary of Mosquito Anatomy. Mosq. Syst. 13(2):201-217. (February)

79. Harrison, B.A., M.C. Callahan, D.M. Watts and L. Panthusiri. 1982. An efficient larval trap for/ sampling Aedes aegypti populations (Diptera: Culicidae). J. Med. Entomol. 19:722-727. (November)

80. Peyton, E.L., D.R. Roberts, F.P. Pinheiro, R. Vargas and F. Balderama. 1983. Mosquito collections from a remote unstudied area of southeastern Bolivia. Mosq. Syst. 15(2):61-89. (September)

81. Zavortink, T.J., D.R. Roberts and A.L. Hoch. 1983. Trichoprosopon digitatum - morphology, biology, and potential medical importance. Mosq. Syst. 15(2):141-149. (September)

66. Sirivanakarn, S. and S. J. Heinemann. 1980. Description of the hitherto unknown adult and pupa of Culex (Melanoconion) simulator (Dyar and Knab), and redescription of its larva (Diptera: Culicidae). Mosq. Syst. 12(1):41-49. (March)

67. Faran, M. E. and C. L. Bailey. 1980. Discovery of an overwintering adult female of Culiseta annulata in Baltimore. Mosq. News 40(2):284-287. (June)

68. Harrison, B. A. 1980. Medical entomology studies XIII. The Myzomyia series of Anopheles (Cellia) in Thailand, with emphasis on intraspecific variations (Diptera: Culicidae). Contr. Am. Entomol. Inst. 17(4):1-195. (October)

69. Peyton, E. L. and B. A. Harrison. 1980. Anopheles (Cellia) takasagoensis Morishita 1946, an additional species in the Balabacensis Complex of Southeast Asia (Diptera: Culicidae). Mosq. Syst. 12(3):335-347. (December)

70. Mattingly, P. F. 1981. Medical entomology studies - XIV. The subgenera Rachionotomyia, Tricholeptomyia and Tripteroides (Mabinii Group) of genus Tripteroides in the Oriental Region (Diptera: Culicidae). Contr. Am. Entomol. Inst. 17(5):1-147. (May)

71. Faran, M. E. 1981. Synonymy of Anopheles (Nyssorhynchus) noroestensis with An. (Nys.) evansi, with a description of the male genitalia of the lectotype of An. (Nys.) evansi (Diptera: Culicidae). Mosq. Syst. 13(1):86-90. (June)

72. Faran, M. E. and K. J. Linthicum. 1981. A handbook of the amazonian species of Anopheles (Nyssorhynchus) (Diptera: Culicidae). Mosq. Syst. 13(1):1-81. (June)

73. Huang, Y.-M. 1981. A redescription of Aedes (Stegomyia) calceatus Edwards and description of a new Afrotropical species, Aedes (Stegomyia) ledgeri (Diptera: Culicidae). Mosq. Syst. 13(1):92-113. (June)

74. Ward, R. A. 1981. Culicidae, pp. 245-256. In S. H. Hurlbert, G. Rodriguez and N. D. Santos, eds. "Aquatic biota of tropical South America, part 1: Arthropoda." San Diego State University, San Diego, Calif., pp. xii+323. (June)

75. Huang, Y.-M. and R. A. Ward. 1981. A pictorial key for the identification of mosquitoes associated with yellow fever in Africa. Mosq. Syst. 13(2): 138-149. (October)

76. Sirivanakarn, S. and N. Degallier. 1981. Redescription of Culex (Melanoconion) portesi Senevet and Abonnenc 1941 with notes on synonymy (Diptera: Culicidae). Mosq. Syst. 13(2):153-167. (October)

77. Reinert, J. F. 1981. Medical entomology studies - XV. A revision of the subgenus Paraedes of the genus Aedes (Diptera: Culicidae). Contr. Am. Entomol. Inst. 18(4):1-91. (November)

53. Reinert, J. F. 1979. A description of Isoaedes, a new subgenus of Aedes Meigen, and its type-species, Ae. (Isa.) cavaticus new species (Diptera: Culicidae). Mosq. Syst. 11(2):144-162. (June)

54. Sirivanakarn, S. 1979. A new species of Culex (Melanoconion) from Bolivia and Ecuador (Diptera: Culicidae). Mosq. Syst. 11(2):135-137. (June)

55. Sirivanakarn, S. and W. L. Jakob. 1979. A new species of Culex (Melanoconion) from Southern Brazil (Diptera: Culicidae). Mosq. Syst. 11(2):139-143. (June)

56. Ward, R. A. 1979. Corrections in the nomenclature of three anophelines (Diptera: Culicidae). Mosq. Syst. 11(2):130-134. (June)

57. Huang, Y.-M. 1979. Medical entomology studies XII. The subgenus Stegomyia of Aedes in the Oriental region with keys to the species (Diptera: Culicidae). Contr. Am. Entomol. Inst. 15(6):1-76. (July)

58. Huang, Y.-M. 1979. Aedes (Stegomyia) simpsoni complex in the Ethiopian region with lectotype designation for simpsoni (Theobald) (Diptera: Culicidae). Mosq. Syst. 11(3):221-234. (September)

59. Peyton, E. L., N. Jayasekera and R. V. Chelliah. 1979. The biology and immature stages of Uranotaenia (Pseudoficalbia) srilankensis Peyton (Diptera: Culicidae). Mosq. Syst. 11(3):215-220. (September)

60. Faran, M. E. 1979. The importance of an integrated approach in solving a problem in mosquito systematics. Mosq. Syst. 11(4):280-288. (December)

61. Tanaka, K., K. Mizusawa and E. S. Saugstad. 1979. A revision of the adult and larval mosquitoes of Japan (including the Ryukyu Archipelago and Ogasawara Islands) and Korea (Diptera: Culicidae). Contr. Am. Entomol. Inst. 16:1-987. (December)

62. Faran, M. E. 1980. Mosquito studies (Diptera: Culicidae) XXXIV. A revision of the Albimanus section of the subgenus Nyssorhynchus of Anopheles. Contr. Am. Entomol. Inst. 15(7):1-215. (March)

63. Huang, Y.-M. and J. C. Hitchcock. 1980. Medical entomology studies XII. A revision of the Aedes scutellaris group of Tonga (Diptera: Culicidae). Contr. Am. Entomol. Inst. 17(3):1-107 (March)

64. Sirivanakarn, S. and J. N. Belkin. 1980. The identity of Culex (Melanoconion) taeniopus Dyar and Knab and related species with notes on the synonymy and description of a new species. Mosq. Syst. 12(1):7-24. (March)

65. Sirivanakarn, S. and P. Galindo. 1980. Culex (Melanoconion) adamesi, a new species from Panama (Diptera: Culicidae). Mosq. Syst. 12(1):25-34. (March)

40. Huang, Y.-M. 1977. A new record of Aedes (Stegomyia) patriciae Mattingly (Diptera: Culicidae). Proc. Entomol. Soc. Wash. 79(4):625 (October)

41. Knight, K. L. and R. E. Harbach. 1977. Maxillae of fourth stage mosquito larvae (Diptera: Culicidae). Mosq. Syst. 9(4):455-477. (December)

42. Sirivanakarn, S. 1977. A new species of Culex (Eumelanomyia) from India with descriptions of pupae and larvae of Cx. pluvialis Barraud and Cx. iphis Barraud (Diptera: Culicidae). Mosq. Syst. 9(4):537-547. (December)

43. Harbach, R. E. and K. L. Knight. 1978. A mosquito taxonomic glossary XIV. The larval body (except chaetotaxy). Mosq. Syst. 10(1):53-105. (March)

44. Harbach, R. E. and K. L. Knight. 1978. A mosquito taxonomic glossary XV. The egg. Mosq. Syst. 10(2):249-298. (June)

45. Huang, Y.-M. 1978. The identity of two species of Stegomyia belonging to the Aedes albolineatus group (Diptera: Culicidae). Mosq. Syst. 10(2):197-210. (June)

46. Sirivanakarn, S. 1978. Revalidation of Culex (Melanoconion) invocator Pazos with a redescription of adults and illustration of male genitalia (Diptera: Culicidae). Mosq. Syst. 10(2):239-245. (June)

47. Sirivanakarn, S. and G. B. White. 1978. Neotype designation of Culex quinquefasciatus Say (Diptera: Culicidae). Proc. Entomol. Soc. Wash. 80(3):360-72. (July)

48. Huang, Y.-M. 1978. Redescription and subgeneric position of Aedes meronephada (Dyar and Shannon) with notes on the subgenus Diceromyia (Diptera: Culicidae). Mosq. Syst. 10(3):335-50. (September)

49. Huang, Y.-M. 1978. Taxonomic status of Aedes (Stegomyia) laffooni Knight and Rozeboom with a redescription of Aedes (Stegomyia) pseudalbolineatus Brug (Diptera: Culicidae). Mosq. Syst. 10(3):351-59. (September)

50. Sirivanakarn, S. 1978. The female cibarial armature of New World Culex, subgenus Melanoconion and related subgenera with notes on this character in subgenera Culex, Lutzia and Neoculex and genera Galindomyia and Deinocerites (Diptera: Culicidae) Mosq. Syst. 10(4):474-92. (December)

51. Faran, M. E. 1979. Anopheles (Nyssorhynchus) trinkae, a new species in the Albimanus Section (Diptera: Culicidae). Mosq. Syst. 11(1):26-39. (March)

52. Peyton, E. L. and B. A. Harrison. 1979. Anopheles (Cellia) dirus, a new species in the Leucosphyrus Group from Thailand (Diptera: Culicidae). Mosq. Syst. 11(1):40-52. (March)

27. Huang, Y.-M. 1977. Medical entomology studies - VII. The subgenus Stegomyia of Aedes in Southeast Asia. II - The edwardsi group of species. III - The W-albus group of species. VIII. Notes on the taxonomic status of Aedes vittatus. (Diptera: Culicidae). Contr. Am. Entomol. Inst. 14(1):1-132. (March)

28. Sirivanakarn, S. 1977. Additional descriptions of three species of Culex (Eumelanomyia) with the description of a new species from Peninsular Malaysia (Diptera: Culicidae). Mosq. Syst. 9(1):73-87. (March)

29. Ward, R. A. 1977. Recent changes in the epidemiology of malaria relating to human ecology. Proc. 15th Int. Cong. Entomol. 498-504. (March)

30. Burger, J. F. 1977. The biosystematics of immature Arizona Tabanidae (Diptera). Trans. Am. Entomol. Soc. 103:145-258. (April)

31. Ward, R. A. 1977. Culicidae, pp. 268-274. In S.H. Hurlbert, ed. "Biota Acuatica de Sudamerica Austral." San Diego State University, San Diego, Calif. (May)

32. Harbach, R. E. and K. L. Knight. 1977. A mosquito taxonomic glossary XI. The larval maxilla. Mosq. Syst. 9(2):128-175. (June)

33. Sirivanakarn, S. 1977. Redescription of four Oriental species of Culex (Culiciomyia) and the description of a new species from Thailand (Diptera: Culicidae). Mosq. Syst. 9(2):93-111. (June)

34. Abercrombie, J. 1977. Medical entomology studies - IX. The subgenus Christophersiomyia of the genus Aedes (Diptera: Culicidae). Contr. Am. Entomol. Inst. 14(2):1-72. (August)

35. Peyton, E. L. 1977. Medical entomology studies - X. A revision of the subgenus Pseudoficalbia of the genus Uranotaenia in Southeast Asia (Diptera: Culicidae). Contr. Am. Entomol. Inst. 14(3):1-273. (August)

36. Sirivanakarn, S. 1977. Medical entomology studies - VI. A revision of the subgenus Lophoceraomyia of the genus Culex in the Oriental region (Diptera: Culicidae). Contr. Am. Entomol. Inst. 13(4):1-245. (August)

37. Harbach, R. E. and K. L. Knight. 1977. A mosquito taxonomic glossary XII. The larval labiohypopharynx. Mosq. Syst. 9(3):337-365. (September)

38. Harbach, R. E. and K. L. Knight. 1977. A mosquito taxonomic glossary XIII. The larval pharynx. Mosq. Syst. 9(3):389-401. (September)

39. Huang, Y.-M. 1977. The mosquitoes of Polynesia with a pictorial key to some species associated with filariasis and/or dengue fever. Mosq. Syst. 9(3):289-322. (September)

13. Huang, Y.-M. 1975. A new species of Aedes (Stegomyia) from Sri Lanka (Ceylon) (Diptera: Culicidae). Mosq. Syst. 7(4):345-356. (December)

14. Sirivanakarn, S. 1975. A new species of Culex (Eumelanomyia) Theobald from Manus Island, Papua-New Guinea (Diptera: Culicidae). Mosq. Syst. 7(4):394-400. (December)

15. Floore, T. G., B. A. Harrison and B. F. Eldridge. 1976. The Anopheles (Anopheles) crucians subgroup in the United States (Diptera: Culicidae). Mosq. Syst. 8(1):1-109. (March)

16. Ward, R. A., B. Jordan, A. R. Gillogly and F. J. Harrison. 1976. Anopheles litoralis King and A. barbirostris Group on the Island of Guam. Mosq. News 36(1):99-100. (March)

17. Reinert, J. F. 1976. Medical entomology studies - IV. The subgenera Indusius and Edwardsaedes of the genus Aedes (Diptera: Culicidae). Contr. Am. Entomol. Inst. 13(1):1-45. (May)

18. Reinert, J. F. 1976. A ventromedian cervical sclerite of mosquito larvae (Diptera: Culicidae). Mosq. Syst. 8(2):205-208. (June)

19. Sirivanakarn, S. and S. Ramalingham. 1976. A new species of Culex (Eumelanomyia) Theobald with notes on three other species from Malaysia (Diptera: Culicidae). Mosq. Syst. 8(2):209-216. (June)

20. Utmar, J. A. and W. W. Wirth. 1976. A revision of the New World species of Forcipomyia, subgenus Caloforcipomyia (Diptera: Ceratopogonidae). Florida Entomol. 59(2):109-133. (June)

21. Sirivanakarn, S. 1976. Medical entomology studies - III. A revision of the subgenus Culex in the Oriental region (Diptera: Culicidae). Contr. Am. Entomol. Inst. 12(2):1-272. (July)

22. Reinert, J. F. 1976. A new man-biting species of Aedes (Paraedes) from Southeast Asia (Diptera: Culicidae). Mosq. Syst. 8(3):319-331. (September)

23. Reinert, J. F. 1976. Medical entomology studies - V. The subgenus Rhinoskusea of the genus Aedes (Diptera: Culicidae). Contr. Am. Entomol. Inst. 13(2):1-60. (November)

24. de Meillon, B. and C. van Eeden. 1976. Anopheles (Cellia) deaconi n. sp., from South Africa (Diptera: Culicidae). Mosq. Syst. 8(4):335-342. (December)

25. de Meillon, B. 1977. The changing pattern in transmission of Bancroftian Filariasis. Proc. 15th Int. Cong. Entomol. 498-504. (March)

26. Harbach, R. E. and K. L. Knight. 1977. A mosquito taxonomic glossary X. The larval mandible. Mosq. Syst. 9(1):25-37. (March)

Appendix 1.

PUBLICATIONS OF THE MEDICAL ENTOMOLOGY PROJECT

1. Harrison, B. A., J. F. Reinert, S. Sirivanakarn, Y.-M. Huang, E. L. Peyton and B. de Meillon. 1974. Distributional and biological notes on mosquitoes from Sri Lanka (Ceylon) (Diptera: Culicidae). Mosq. Syst. 6(2):142-162. (June)

2. Huang, Y.-M. 1974. A new species of Aedes (Stegomyia) from Andaman Island. (Diptera: Culicidae). Mosq. Syst. 6(2):137-141. (June)

3. Huang, Y.-M. 1974. Lectotype designation for Aedes (Stegomyia) chemulpoensis Yamada with a note on its assignment to the aegypti group of species (Diptera: Culicidae). Proc. Entomol. Soc. Wash. 76:208-211. (June)

4. Peyton, E. L. 1974. Uranotaenia srilankensis, a new species of the subgenus Pseudoficalbia from Sri Lanka (Diptera: Culicidae). Mosq. Syst. 6(3):222-228. (October)

5. Huang, Y.-M. 1974. Occurrence of two types of gynandromorphism in a sibling series of Aedes (Stegomyia) craggi (Barraud) (Diptera: Culicidae). Mosq. News 34(4):428-430. (December)

6. Reinert, J. F. 1974. Medical entomology studies - I. A new interpretation of the subgenus Verrallina of the genus Aedes (Diptera: Culicidae). Contr. Am. Entomol. Inst. 11(1):1-249. (December)

7. Sirivanakarn, S. 1974. Redescription of Culex (Culex) bihamatus Edwards with a discussion of its affinity (Diptera: Culicidae). Mosq. Syst. 6(4):259-262. (December)

8. Harrison, B. A. and J. M. Klein. 1975. A revised list of the Anopheles of Cambodia. Mosq. Syst. 7(1):9-12. (March)

9. Huang, Y.-M. 1975. A redescription of Aedes (Stegomyia) pseudoscutellaris (Theobald) with a note on the taxonomic status of Aedes (Stegomyia) polynesiensis Marks (Diptera: Culicidae). Mosq. Syst. 7(1):87-101. (March)

10. Sirivanakarn, S. 1975. The systematics of Culex vishnui complex in Southeast Asia with the diagnosis of three common species (Diptera: Culicidae). Mosq. Syst. 7(1):69-70. (March)

11. Reinert, John F. 1975. Mosquito generic and subgeneric abbreviations (Diptera: Culicidae). Mosq. Syst. 7(2):105-110. (June)

12. Harrison, B. A. and J. E. Scanlon. 1975. Medical entomology studies - II. The subgenus Anopheles in Thailand (Diptera: Culicidae). Contr. Am. Entomol. Inst. 12(1):1-307. (December)

Overall, the continuing association of specialists assigned to WRAIR and detailed to MEP and working with our own specialists has proven to be highly beneficial. During the course of MEP most of the recognized specialists in other parts of the world have died or retired, and as a result pleas for help have become more and more strongly focused on the project. The combined group has now become virtually the only source of expert aid to other workers, agencies and governments. The continuing cooperation must be continued as we have become, literally, the last hope for help from most parts of the world.

RECOMMENDATIONS

Although both SEAMP and MEP were primarily concerned with the taxonomy of the mosquitoes of southeastern Asia, the scope of MEP was from the start more limited than that of its predecessor. The three main projects at the beginning were revisions of the genera Culex, Aedes (Stegomyia) and Uranotaenia in southeastern Asia. Many revisions of large subgenera in all three genera were published, yet the subgenus Culiciomyia of Culex, the Albolineatus Group of Stegomyia, and the subgenus Uranotaenia were not revised as these three projects were terminated before completion. Tragically, the last revision is still sitting nearly complete upon the shelf. Work was then initiated on the Asian Anopheles vectors of malaria, which project is still continuing within WRBU. Upon termination of the Asian Culex work, a project on the New World subgenus Melanoconion of Culex, the primary vector of several arboviruses in the Americas, was initiated. Unfortunately, just when this work was getting well underway, budget cuts forced the termination of the project. Consequently, only fragmentary results were obtained, and nearly 4 years of support were mostly wasted. Upon termination of the Asian Stegomyia project, work commenced on African Stegomyia. This work is still being supported under the Systematics of Aedes Mosquitoes Project. It can not be urged too strongly that funding for this project be continued until the work is completed. The same is to be urged for the Asian Anopheles studies still being supported by WRBU.

The tremendous influx of material has been in general well handled, but the quantity has made it impossible for the limited support staff to adequately curate it. An effort has begun to integrate material from various sources into a single collection in which all available material can be easily found. This effort is commended and we hope it will be carried to completion. A far more serious problem, that had begun in the days before the existence of SEAMP or MEP and has become ever more acute as a result of the limitation of support staff, is the inadequate labelling of specimens and slides. Even though all recent material has carefully received code numbers, the policy of the Department of Entomology, based on long years of experience, requires individual labelling of all material with the basic data. The keys to codes have too frequently become lost or separated from material with the resulting loss of any value to the material. We urge that direction and support be given to properly labelling this material before it is too late.

During the years of SEAMP only a single large field trip to the Philippines was supported by the project. During the years of MEP, three major field trips were funded through the project: two to Africa by Huang, and one to South America by Peyton. Additional field work by WRBU and MEP personnel has been funded direct from WRAIR. These field activities have resulted in many thousands of individually reared, excellently prepared specimens. They are, in fact, the most valuable material that is received in the project, and mostly of immediate value to current research. This work in the field is extremely valuable to the researcher. Not only does he obtain what he knows he needs, he has an opportunity to see the species in its normal environment. He thus gains an understanding of how and where it lives, something that can not be gained solely from reading. This increasing support is commendable and we recommend that it be continued and increased in frequency in the future.

Dr. B.A. Harrison, leader of the Unit, continued his study and examination of Anopheles specimens from northern Africa and southwest Asia. A collecting trip to Egypt and Israel provided 531 urgently needed adults of 8 Anopheles species, most with associated immature skins. Included in these were 65 specimens of a new species from Egypt. Some of these specimens will be used as the type-series in a forthcoming description of the species by collaborating Egyptian researchers at Ain Shams University in Cairo.

Dr. T.J. Zavortink has currently completed descriptions for larvae, pupae and male genitalia of all 22 species of the Neotropical genus Trichoprosopon. In addition the descriptions for the adults are complete for over half of these species, including the 8 new species found to date. Most of the required illustrations are in the correction phase, with only a few originals needed. Keys have been completed for larvae, pupae, adults and genitalia of all species. During the year a paper outlining the biology and medical significance of Trichoprosopon digitatum was published. In addition, 2 new species of Wyeomyia were discovered in Venezuela and are being described. Also, a new genus is being described for 2 species previously assigned to Topomyia in Southeast Asia.

2. Other Activities

a. Curatorial work

During the past year work commenced on the integration of various small, segregated collections into a whole, uniformly curated master collection. Nearly 1000 slide boxes from the old National Museum Collection were integrated into the system during the past year. Work commenced integrating certain genera of the pinned collection as well.

The 50 accessions received in MEP amounted to 26,216 items, an exceptionally productive year. Official field trips of the Walter Reed Biosystematics Unit personnel to Egypt, Israel, Peru and Senegal accounted for 15,763 of the items, and the field work of Dr. Huang in Cameroon and Kenya for another 2,228 items. Such collctions by personnel associated with the Project are most valuable because they add not only large quantities of material, but the material is usually individually reared and field pinned, thus of the highest quality. A large collection of 2,965 slides of whole larvae was received from the U.S. Army Environmental Hygiene Command, thru Dr. Joseph Cook. This valuable collection is strong in species from the Pacific area and North America. Of the 28 outgoing shipments, 10 involved specimens totally 456 individuals.

b. Publications

During the year two papers (numbers 80 and 81 of Appendix 1) receiving support from MEP were published. An additional half dozen papers that have received support from the project are in press, awaiting final review, or completion and will appear after the project has been officially terminated.

forward by Yiau-Min Huang, until the termination of her funding under MEP on 31 July 1983 at which time she transferred to Systematics of Aedes Mosquitoes Project, a new program in which she continues the same studies. Her report for the entire year is given here.

Taxonomic efforts focused on the African Aedes (Stegomyia) arbovirus vectors were greatly enhanced by additional specimens collected in or received from Cameroon, Kenya, and South Africa. Nine new species are currently recognized in the important Africanus, Simpsoni, Poweri and Pseudonigeria Subgroups of Aedes (Stegomyia). These new species plus the recently elevated species, lilii and bromeliae, will force drastic changes in the names of species that have been implicated and published in the past as arbovirus vectors in Africa. Examples of changes are: (1) the species previously called simpsoni in Uganda that bites man and was incriminated as an enzootic Yellow Fever vector in primates, is actually bromeliae, and the non-human biting species called simpsoni in Uganda is probably lilii. Aedes simpsoni is now known to be restricted to South Africa; and (2) the species previously called africanus in eastern Africa and incriminated as a primary vector of Yellow Fever during large human epidemics in Ethiopia, is actually a new species, while true africanus is restricted to western Africa. This knowledge has become evident only because of several successful collecting trips to various countries in Africa over the last 4 years.

A large portion of the year was spent on a major field trip to Cameroon and Kenya between March 15 and June 23. During this trip emphasis in the Cameroon was placed on obtaining reared material of the Africanus Complex of Aedes (Stegomyia). A total of 14 species belonging to 4 genera were taken including 2 new species of the Africanus complex, and 2 species newly recorded for Cameroon. The time in Kenya was divided into three parts: (1) to complete the examination of material in the collection of the Division of Vector Borne Disease (DVBD); (2) conduct a training course on mosquito vectors for the DVBD; and (3) to undertake field work around Nairobi and in the west. All of the Stegomyia material in the DVBD was examined, recorded, and 116 of the most important specimens borrowed for study. A 10 day training course was given to 13 students from 7 different institutions which included field and laboratory work. Field work completed around Nairobi and Mombasa resulted in large collections containing 38 species of 6 genera. These resulted in six species of Stegomyia, possible 4-5 new species in Aedes, Culex and Anopheles, plus the new record of Aedes circumluteolus for Kenya. A major benefit of this trip is the close professional working relations that has been established with French researchers in ORSTOM institutes, several South African researchers, and with the personnel of the DVBD, Nairobi, Kenya.

c. Work of associated personnel (Walter Reed Biosystematics Unit)

Dr. R.E. Harbach made excellent progress during the year on the revision of the Culex (Culex) of northern Africa and Southwest Asia. Of the 21 species involved in this study, several thousand adults of 9 species (most with associated immature skins) were collected during a highly successful collection trip to Egypt and Israel. These specimens, particularly the immature stages, were urgently needed so that illustrations, setal counts, descriptions and keys could be prepared. To date, the adult descriptions, pupal chaetotaxy charts and pupal illustrations have been completed for 16 species.

REVIEW OF PROGRESS FOR THE PERIOD JANUARY-OCTOBER 1983

1. Biosystematics Studies on Culicidae

a. Genus Anopheles

Subgenus Cellia (Leucosphyrus Group) of the Oriental Region. This project under E.L. Peyton was initiated by MEP and carried forward until 15 Jan 83 at which time Mr. Peyton transferred to the Walter Reed Biosystematics Unit where he is continuing with these studies. Because of the impossibility of dividing his studies accurately, the following reports on his whole years activities in the Leucosphyrus Group.

Considerable progress was made during the year on a revision of the Leucosphyrus Group of Anopheles (Cellia). This study, a collaborative effort involving researchers at the AFRIMS Laboratory and at Mahidol University in Bangkok, Thailand, has intensified over the last year and has shown that the species originally called balabacensis balabacensis in mainland countries and Taiwan in the Orient actually represents at least 7 sibling species in the Dirus Complex (dirus A, B, C, D, E, Con Son Form and takasagoensis). The separate species status of C, D and E was only suspected until this year, when cross-mating and cytogenetic studies in Bangkok revealed hybrid sterility in crosses and distinctive heterochromatin and polytene banding patterns on the chromosomes. Of the 7 sibling members in this complex, dirus A, B, C and D are all found in Thailand where it is not uncommon to find 2-3 species together. The epidemiological implications of these findings for malaria transmission may be far reaching and other studies are in progress to determine the impact of sibling species differences on human malaria transmission in Thailand. The Dirus Complex, when combined with the Balabacensis Complex, i.e., balabacensis, baisasi and introlatus, forms an assemblage of 10 valid species from what was considered one species with 2 subspecies and one form (balabacensis and subspecies baisasi and introlatus, and the Frasers Hill form) only 6 years ago. This example of sibling speciation is already larger than the very popular Gambiae Complex in Africa, and is approaching the size of the famous Maculipennis Complex in the Palearctic Region. Sibling species in Anopheles have been detected at an ever increasing rate over the last 10 years by the use of rapid biochemical and cytogenetic techniques. However, the discovery of the Dirus Complex is unique in that all of the species in the complex were initially separated and recognized by modern morphological studies at MEP, and then were confirmed as distinct species by biochemical, cytogenetic or crossing studies at a later time. Anopheles dirus C, a species currently known only from Thailand, probably has the best morphological characters for species separation. This species is easily recognized in the adult, pupal and larval stages, and a manuscript naming and describing this species is nearing completion. A manuscript naming and describing dirus D is also nearly finished. During this period the larval and pupal stages of Anopheles elegans, another member of the Leucosphyrus Group, were described and illustrated and the paper is currently in press. Intraspecific variation was also detected in the amounts and position of heterochromatin bands in the mitotic chromosomes of dirus A in Thailand, and this paper is in press.

b. Genus Aedes

Subgenus Stegomyia of the African Region. This study is carried

Appendix 3.

MAJOR ACCESSIONS OF THE MEDICAL ENTOMOLOGY PROJECT

		No of Specimens*
1.	AFRIMS Medical Research Laboratory Bangkok, Thailand	28,958
2.	MEP, official field trips	27,151
3.	WRAIR, official field trips	26,492
4.	Dr. J.N. Belkin, University of California Los Angeles, California	15,737
5.	Dr. K. Tanaka, U.S. Army Medical Laboratory Sagamihara City, Japan	6,363
6.	Mr. B.N. Mohan, Coonor, India	4,449
7.	U.S. Army, various units	4,323
8.	Dr. K.L. Knight, North Carolina State University Raleigh, North Carolina	3,546
9.	Dr. R. Rosenberg, National Institute of Health Bethesda, Maryland	3,434
10.	NMNH staff, official field trips	2,530
11.	Mr. W.L. Jakob, Centers for Disease Control Fort Collins, Colorado	2,232
12.	MAJ E.S. Saugstad, U.S. Army Health and Environment Activity, Ft. Meade, Maryland	2,139
13.	Dr. S. Ramalingam, University of Malaya Kuala Lampur, Malaysia	1,807
14.	Dr. J.C. Hitchcock, World Health Organization Nukualofa, Tonga	1,495
15.	Dr. L.T. Nielsen, University of Utah Salt Lake City, Utah	1,265
16.	Dr. J. Hayes, Texas Technical School of Medicine Lubbock, Texas	1,198

*Includes adults, slides, vials, unmounted material and egg lots.

17.	U.S. Navy, various units	1,138
18.	Dr. D.J. Pletsch, AID/HEALTH Jakarta, Indonesia	743
19.	Dr. D.J. Borror, Ohio State University Columbus, Ohio	629
20.	Capt. L.W. Teller, Armed Forces Pest Control Board, Forest Glen, Maryland	598
21.	National Institute of Tropical Disease South Africa	522
22.	Mr. J. Muspratt, Johannesburg, South Africa	472
23.	Dr. R.H. Baker, University of Maryland College Park, Maryland	402
24.	Dr. Y. Wada, National Institute of Health Tokyo, Japan	382
25.	Dr. W.K. Reisen, Arbovirus Field Station Bakersfield, California	343
26.	Dr. L.P. Lounibos, Florida Medical Entomology Laboratory, Vero Beach, Florida	309
27.	Dr. R.F. Darsie, Jr., Centers for Disease Control, Atlanta, Georgia	264
28.	Dr. J. Maldonado Capriles, Ponce School of Medicine, Ponce, Puerto Rico	264
29.	Dr. L.E. Rozeboom, Johns Hopkins University Baltimore, Maryland	258
30.	Dr. F.W. Mead, Florida State Collection of Arthropods, Gainesville, Florida	253
31.	Capt. D.A. Strickman, U.S. Air Force San Antonio, Texas	215
32.	Dr. B. de Meillon, Philadelphia, Pennsylvania	211

Appendix 4.

SUMMARY OF ACCESSIONS FROM 1 JUNE 1974 TO 30 SEPTEMBER 1983

600 different accessions:

108,910	pinned adults
35,845	slides
32,948	vials of immatures
973	unmounted adults
178,676	specimens

In addition 766 lots of unmounted adults and 310 lots of eggs for rearing were received.

Appendix 5.

MEP EMPLOYEES AND PROFESSIONAL ASSOCIATES

NAME	DATES OF SERVICE
Abercrombie, Jay, Dr.	01 JUN 74 - 11 JAN 75 - WRAIR
Ackerman, Susan	11 SEP 77 - 24 SEP 77
Benton, Linda Y.	23 AUG 76 - 03 JUN 77
Bosma, Julia M.	14 OCT 75 - 14 AUG 76
* Bryce, George K.	28 MAR 76 - 31 DEC 79
Buescher, Michael D.	28 SEP 75 - 15 MAY 76
* Burger, John F.	27 JAN 75 - 31 AUG 75
Cantu, Dolores	10 AUG 81 - 30 JUN 82
Cavey, Laurie A.	11 MAY 75 - 14 AUG 76
Chang, Suzanne Chien C.	01 JUN 74 - 01 JUL 77
Curtis, Owilda J.R.	01 JUN 74 - 30 JUN 76
Faitoute, Robin	24 MAR 80 - 17 JAN 81
* Faran, Michael E.	28 MAR 76 - 30 JUN 77
	09 AUG 77 - 27 MAY 82 - WRAIR
Farrior, Marian	27 APR 81 - 30 JUN 82
Ford Smith, Thelma L.	01 JUN 74 - 18 JUN 77
Ford, Virginia M.	01 JUN 74 - 18 JUN 77
Gordon, Gloria E.	01 JUN 74 - 30 JUN 76
Gaffigan, Thomas V.	01 JUN 74 - 15 JAN 82
* Harbach, Ralph E., Dr.	23 MAY 80 - 31 SEP 83 - WRAIR
* Harrison, Bruce A., Dr.	04 JAN 82 - 31 SEP 83 - WRAIR
Harrison, Sharon G.	23 AUG 76 - 08 OCT 76
	22 JAN 79 - 23 FEB 80
Hevel, Susan	01 JUN 74 - 25 APR 75
Hochman, Robert	01 JUN 74 - 23 AUG 74
Hoskins Dery, Ann	01 JUN 74 - 09 AUG 80
* Huang, Yiau-Min, Dr.	01 JUN 74 - 01 AUG 73
* Linthicum, Kenneth	28 MAR 76 - 25 MAR 78
Lomax, Cynthia E.	17 OCT 77 - 23 DEC 78
Malikul, Vichai	01 JUN 74 - 30 JUN 83
Manion, Anne G.	08 MAR 76 - 01 JUN 76
Markowitz, Norman L.	01 JUN 75 - 22 MAY 76
Munro, Susan Gale	21 OCT 79 - 31 DEC 82
Page, Ellen M.	29 OCT 74 - 26 JAN 80
* Peyton, E.L.	01 JUN 74 - 14 JAN 83
	15 JAN 83 - 31 SEP 83 - WRAIR
Powder, William A.	10 MAR 76 - 10 JUN 76
* Reinert, John F., Dr.	01 JUN 74 - 14 JUN 75 - WRAIR
Rupp, Janet D.	01 JUN 74 - 31 SEP 83
Schiff, Lotte B.	01 JUN 74 - 30 JUN 80
Sims, Ruby	11 JUL 77 - 30 JUN 78
* Sirivanakarn, Sunthorn, Dr.	01 JUN 74 - 30 JUN 80
Smallwood, Penelope B.	01 JUN 74 - 30 JUN 80

*Entomologist

Sohn, Young T.	01 JUN 74 - 31 JAN 81	
Spangler, Phyllis	16 SEP 74 - 31 MAY 80	
Starcke, Helle	01 JUN 74 - 30 JUN 76	
* Ward, Ronald A., Dr.	01 JUN 74 - 20 JUL 80	- WRAIR
White, Lawrence, Jr.	01 JUL 74 - 01 JUN 76	
Utmar, Joyce A.	21 JUL 74 - 30 JUN 78	

Appendix 6.

MEDICAL ENTOMOLOGY PROJECT CONSULTANTS

MAJ Richard G. Andre, AFRIMS, Bangkok, Thailand - malaria vectors (1981-1983).

Dr. John N. Belkin, University of California, Los Angeles, CA - New World Culicidae (1975-1979).

Dr. Pedro Galindo, Gorgas Memorial Laboratory, Balboa Heights, Canal Zone - New World Culicidae (1975-1983).

CPT Jayson I. Glick, USA Medical Research Institute of Infectious Diseases, Fort Detrick, MD - African Ceratopogonidae (1981-1983).

Dr. Douglas J. Gould, SEATO Medical Research Laboratory, Bangkok, Thailand - Culicidae of Thailand (1974-1975).

LTC Bruce A. Harrison, North Carolina State University, Raleigh, NC (1974-1977); AFRIMS, Bangkok, Thailand - Oriental Anopheles (1977 - 1981).

Dr. James B. Hitchcock, World Health Organization, Tonga - Aedes (Stegomyia) of South Pacific (1974-1979).

Dr. J.M. Klein, ORSTOM, Papeete, Tahiti - Oriental Culicidae (1974-1983).

Professor Kenneth L. Knight, North Carolina State University, Raleigh, NC (1974-1983).

Dr. Peter F. Mattingly, British Museum (Natural History), London, England (1974-1983).

Dr. Botha de Meillon, Siegfried Annecke Institute, Tzaneen, South Africa - Culicidae and Ceratopogonidae of Africa (1974-1983).

Mr. J. Mouchet, ORSTOM, Bondy, France - Culicidae (1979-1983).

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